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United States Patent [19]

Sansone

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| [54] | LENGTH | AND | ELONGATION | SENSOR |
|------|--------|-----|-------------------|--------|
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| [75] | Inventor: | Louis | Ε. | Sansone. | Brooklyn | Conn. |
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[73] Assignee: The United States of America as represented by the Secretary of the

Navy, Washington, D.C.

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[56] References Cited

U.S. PATENT DOCUMENTS

| 4,928,004 | 5/1990 | Zimmermann et al 250/227.14 |
|-----------|---------|-----------------------------|
| 4,950,886 | 8/1990 | Claus et al 250/227.14 |
| 5,359,405 | 10/1994 | Andrews 356/35.5 |
| 5,381,005 | 1/1995 | Chazelas et al 250/227.19 |

| 5,488,475 | 1/1996 | Friebele et al | 356/352 |
|-----------|--------|----------------|---------|
| 5,499,313 | 3/1996 | Kleinerman | 385/123 |

Primary Examiner-Mark Hellner

Attorney, Agent, or Firm—Michael J. McGowan; Prithvi C.

Lall; Michael F. Oglo

[57] ABSTRACT

A length and elongation sensor includes an elastomeric optical wave guide and a time domain reflectometer. The elastomeric optical wave guide consists of a urethane outer cladding and an optical gel core. A transparent window is hermetically sealed to the first end of the optical wave guide and a reflective mirror is hermetically sealed to the second end of the optical wave guide. Both ends of the wave guide are then fixedly attached to the unit to be measured. The time domain reflectometer is operative for propagating a light pulse through the optical wave guide and for measuring the round-trip propagation time of the light pulse. Since the velocity of the light pulse is known, the length of the wave guide can easily be determined. The wave guide is stretchable up to 25% of its original length thereby allowing both static and dynamic length measurements of the unit to be measured.

6 Claims, 1 Drawing Sheet

